UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/587,546	01/05/2007	Jinbo Bai	BJS-5006-11	9696

23117 7590 01/20/2010

NIXON & VANDERHYE, PC
901 NORTH GLEBE ROAD, 11TH FLOOR
ARLINGTON, VA 22203

EXAMINER	
MCCRACKEN, DANIEL	
ART UNIT	PAPER NUMBER
1793	
MAIL DATE	DELIVERY MODE
01/20/2010	PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/587,546	BAI ET AL.	
	Examiner	Art Unit	
	DANIEL C. MCCRACKEN	1793	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE *3* MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *9/23/2009*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-17* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-17* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Citation to the Specification will be in the following format: (S. # : ¶/L) where # denotes the page number and ¶/L denotes the paragraph number or line number. Citation to patent literature will be in the form (Inventor # : LL) where # is the column number and LL is the line number. Citation to the pre-grant publication literature will be in the following format (Inventor # : ¶) where # denotes the page number and ¶ denotes the paragraph number.

Status of Application

Applicants' response dated 9/23/2009 has been received and will be entered. Claims 1-17 are pending. Claims 1-12 are currently amended and Claims 13-17 are newly presented.

Response to Arguments

Drawings

The replacement drawings have been received. Certain remarks were made to the effect that these drawings were already present in the file wrapper. *See e.g.* (Remarks of 9/23/2009 at 7) ("Entry of the attached eight (8) sheets of drawings is requested, in place of the eight (8) sheets of drawings contained in the PTO IFW indexed at July 28, 2006, as originally-filed with the application."). As noted in the Non-final Office Action, the only copies of the drawings uncovered upon review of the file wrapper were those published in the international/WIPO publication. No separate drawing sheets were found. The requirement for separate drawing sheets was made to insure that these were found by the printers in the event a patent ever issues. The issue is now resolved. The drawings requirement is WITHDRAWN.

Claim Rejections – 35 U.S.C. §112

I. With respect to the rejection of Claims 1 and 5 under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention, Applicants state "The claims have been revised, without prejudice, to obviate the Section 112, second paragraph, rejection of claims 1 and 5. Withdrawal of the rejection is requested." (Remarks of 9/23/2009 at 7). No specific traversal was presented. The claims have been reviewed, and have been amended to recite separate a carbon source and a catalyst. The rejection is WITHDRAWN in light of Applicants' amendments.

Claim Rejections – 35 U.S.C. §102

I. With respect to the rejection of Claims 1-7 and 11-12 under 35 U.S.C. 102(b) as being anticipated by Ma, et al., *Catalytic growth of carbon nanofibers on a porous carbon nanotubes substrate*, J. Mater. Sci. Letters 2000; 19: 1329-1931, Applicants state "[t]he Section 102 rejection of claims 1-7 and 11-12 over Ma (Catalytic Growth of Carbon Nanofibers on a Porous Carbon Nanotubes Substrate, Journal of Material Science Letters 2000; 19:1329-1931), is obviated by the above amendments." (Remarks of 9/23/2009 at 7). Applicants appear to rely solely on amendments, but do present several observations including: "in the claimed process, the support is contacted with a mixture of a carbon source compound and a catalyst into a stream of inert gas and hydrogen (i.e. the support comes into contact with the catalyst at the same time as the carbon source compound)." (Remarks of 9/23/2009 at 8). Because of this newly claimed feature, the rejection of Claims 1-10 (*i.e.* the process/method claims) is WITHDRAWN. Certain

"advantages" of the claimed process were presented – *see* (Remarks of 9/23/2009 at 8-10) - but these are not relevant (and in turn not persuasive) in an anticipation analysis. MPEP 2131.04. ("Evidence of secondary considerations, such as unexpected results or commercial success, is irrelevant to 35 U.S.C. 102 rejections and thus cannot overcome a rejection so based."). As noted above, the rejection is withdrawn due to the new embodiment created by the amendments.

With respect to the rejection of Claims 11-12 (*i.e.* the product claims), Applicants traversal is on the grounds that:

> with regard to claims 11 and 12, that Ma describes carbon nanofibers bound to porous carbon nanotubes pellets as substrate. Furthermore, the applicants understand the supports to have dimensions of 10 mm x 10 mm x 1 mm (page 1929, col. 1, lines 39-42). However, Ma is not understood to disclose carbon nanotubes bonded to nanoscale/microscale carbon fiber or ceramic fiber support materials, much less multiscale composites formed therefrom. Furthermore, the applicants believe that the cited art fails to literally or inherently disclose carbon nanotubes bonded to nanoscale/microscale supports in a polymer, metal or ceramic matrix, much less multiscale composites comprising them.

(Remarks of 9/23/2009 at 10). These remarks appear to address the newly claimed embodiment versus the claims as previously filed. That said, it is noted that no support size is claimed, making comparison to Ma on these grounds irrelevant. Likewise, no structural distinction is seen between the claims as now drafted and the disclosure in Ma. Carbon nanofibers and carbon nanotubes are both present and bound to each other. *See* (Ma at 1930, col. 2 – caption for Figure 5) ("SEM pictures of carbon nanofibers formed on porous CNTs pellets."). The rejection of Claims 11-12 is MAINTAINED, updated below to address the claim amendments.

Claim Rejections – 35 U.S.C. §103

I. With respect to the rejection of Claims 1-10 under 35 U.S.C. 103(a) as being unpatentable over Rao, et al., *Synthesis of multi-walled and single-walled nanotubes, aligned-nanotube bundles and nanorods by employing organometallic precursors*, Mat Res Innovat 1998; 2: 128–141 in view of Ma, et al., Processing and properties of carbon nanotubes–nano-SiC ceramic, Journal of Materials Science 1998; 33: 5243-5246 ("Ma II"), Applicants traversal is on the grounds that:

> The applicants believe that Rao does not describe or suggest a process for obtaining carbon nanotubes bound to supports. The applicants believe that Rao does not describe or suggest a process of the claims wherein a mixture of catalyst and carbon source compound are contacted with nanometric and/or micrometric-sized supports in a simultaneous fashion.

(Remarks of 9/23/2009 at 11). This distinction was recognized in the office action, and a secondary reference ("Ma II") was provided to remedy the failure of Rao to disclose the claimed supports. Applicants discuss Ma II at page 13 of the remarks. The remarks provide observations of the Ma II document, but do not traverse the motivation articulated in the office action, namely "grow[ing] nanotubes on SiC for any number of reasons, for example the elimination of the mixing step Ma II employs to make their ceramics/composites." (Non-final Office action of 6/23/2009 at 5). As such, the remarks were not understood. Likewise, as the remarks fail to traverse the motivation, the analysis is presumed proper.

Certain remarks were made with respect to the references that are briefly addressed herein. For example, Rao was alleged to "require[] an elaborate apparatus with two furnaces and temperature controllers." (Remarks of 9/23/2009 at 11). This is not persuasive, as the claim does not exclude two furnaces, etc. *See* MPEP 2111.03 (note the definition of "comprising").

Furthermore, the implication was made that Rao does not produce carbon nanotubes bound to supports. *See* (Remarks of 9/23/2009 at 12) ("*In contrast*, the claimed process leads to carbon nanotubes bound to supports with a uniform cover and to prepare composite materials with enhanced reinforcing effects.") (emphasis added). Rao in fact teaches that the nanotubes are bound to the catalyst, and in turn, to whatever the catalyst is deposited on during the growth process. *See* (Rao at 128, col. 2) ("Since the metal particles play such a crucial role in the formation of nanotubes by the pyrolysis of hydrocarbons, it was our view that there may be considerable advantage in making use of organometallic precursor molecules which on decomposition not only act as a source of carbon but also *give rise to small metal clusters or particles which act as catalysts to form the nanotubes.*") (emphasis added). In a sense, the process might be thought of a coating step (the catalyst) followed by a growth or CVD step where the hydrocarbon decomposes and grows the nanotubes. The rejection is MAINTAINED, but updated to address the newly claimed embodiment.

II. With respect to the rejection of Claims 2-4 and 9-10 under 35 U.S.C. 103(a) as being unpatentable over Rao, et al., *Synthesis of multi-walled and single-walled nanotubes, aligned-nanotube bundles and nanorods by employing organometallic precursors*, Mat Res Innovat 1998; 2: 128–141 as applied to claim 1 above, and further in view of US 2003/0119920 to Wang, et al., Applicants traversal is apparently on the grounds that:

> The applicants believe however that Wang does not disclose nor suggest a process whereby a mixture of the carbon source and catalyst are contacted with the support in a simultaneous fashion. Moreover, the applicants believe that Wang does not disclose nor suggest a process wherein the supports are nanometric and/or micrometric-sized.

(Remarks of 9/23/2009 at 14). This is a piecemeal treatment of the reference. One cannot show nonobviousness by attacking references individually where the rejections are based on combinations of references. See *In re Keller*, 642 F.2d 413, 208 USPQ 871 (CCPA 1981); *In re Merck & Co.,* 800 F.2d 1091, 231 USPQ 375 (Fed. Cir. 1986). The finding for which Wang was relied upon, namely the supports of Claims 2-4 and 9-10, was not traversed. The remarks above related to Rao disclosing a coating process are equally applicable. The rejection is MAINTAINED, but updated to address the newly claimed embodiment.

III. With respect to the rejection of Claims 2-4 and 9-10 under 35 U.S.C. 103(a) as being unpatentable over Rao, et al., *Synthesis of multi-walled and single-walled nanotubes, aligned-nanotube bundles and nanorods by employing organometallic precursors*, Mat Res Innovat 1998; 2: 128–141 and US 2003/0119920 to Wang, et al.. as applied to claim 1 above, and further in view of US 2006/0052509 to Saitoh, Applicants traversal

> The applicants submit however that Saitoh does not disclose nor suggest a process whereby a mixture of the carbon source and catalyst are contacted with the support in a simultaneous fashion. Moreover, this document does not disclose nor suggest a process wherein the step of contacting is effected by chemical vapor deposition (CVD). Furthermore, this document does not disclose nor suggest a process wherein the supports are nanometric and/or micrometric-sized.

(Remarks of 9/23/2009 at 15). This is a piecemeal treatment of the reference. One cannot show nonobviousness by attacking references individually where the rejections are based on combinations of references. See *In re Keller*, 642 F.2d 413, 208 USPQ 871 (CCPA 1981); *In re Merck & Co.,* 800 F.2d 1091, 231 USPQ 375 (Fed. Cir. 1986). The finding for which Saitoh was

relied upon, namely the coating in Claims 9-10, was not traversed. The rejection is MAINTAINED, but updated to address the newly claimed embodiment.

Claim Rejections - 35 USC § 102

The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action.

I. Claims 1-8, 11 and 15 are rejected under 35 U.S.C. 102(b) as being anticipated by Singh, et al., *Towards the production of large-scale aligned carbon nanotubes*, Chemical Physics Letters 2003; 372: 860-865 (hereinafter "Singh at __") in view of US 5,770,099 to Rice, et al. and Peter J. Heaney, "Quartz", in AccessScience@McGraw-Hill, http://www.accessscience.com, DOI 10.1036/1097-8542.563500, accessed on 6 January, 2010 (hereinafter "Heaney at __") to show a state of fact.[1]

With respect to Claim 1, Singh teaches a process for growing nanotubes on quartz particles. (Singh at 861, col. 2). The quartz particles have "a thickness of not more than 100 nm and diameters of several microns." *Id.* Singh actually suggests smaller particles, by virtue of the ball milling disclosed. *Id.* As such, they are "nanometric and/or micrometric-sized." The chemical formula for quartz is silicon dioxide, SiO_2. *See* (Heaney at 1) ("Quartz is a crystalline form of silicon dioxide (SiO_2)."). Thus Heaney is provided to explain the meaning of the term "quartz" in the Singh reference. Heaney is an encyclopedia accessed in 2010 (*i.e.* a non-102 date), but note that the bibliography references 102(b) date references. (Heaney at 4). Likewise, similar teachings can be found in 102(b) patent literature. *See e.g.* (Rice 2: 12) ("quartz (silicon dioxide)") (only relied on to show that quartz is known as silicon dioxide). SiO_2 is one of the

[1] Multiple reference rejections under 35 U.S.C. 102 are proper when the extra references are cited to, *inter alia* "[e]xplain the meaning of a term used in the primary reference." MPEP 2131.01.

"ceramic supports" described in the Specification at *e.g.* (S. 9: 20) and claimed/defined in a dependent claim (Claim 4). These supports are contacted with a carbon source and a catalyst in an inert/hydrogen stream. (Singh at 861, col. 1) (ferrocene/toluene). The reaction is carried out in the vapor phase, *i.e.* it is a "CVD" process. *Id.* As to Claim 2, a temperature of 700-760 °C is taught. Note that Singh also discloses characterization of the product with a scanning electron microscope, suggesting that the product was cooled to room temperature. As to Claims 3-4, Singh discloses quartz (*i.e.* SiO_2) flakes or particles. (Singh at 861, col. 2). As to Claims 5 and 15, toluene is a liquid hydrocarbon As to Claim 6, ferrocene (an iron metallocene) is taught. (Singh at 861, col. 1). As to Claim 7, a solution of 2-9.6 wt% ferrocene is taught. (Singh at 861, col. 1). As to Claim 8, a 10% inert/hydrogen mixture is taught. *Id.*

With respect to Claim 11, this is a product-by-process claim. Process limitations are not given patentable weight, except to the extent they suggest structural or compositional features. As noted above with respect to Claim 1, the claimed method is taught. Likewise, quartz with nanotubes and catalyst disposed thereon is taught. (Singh at 863, "Fig. 3").

Claim Rejections - 35 USC § 103

The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action. As to the rejection under 35 U.S.C. §§ 102/103, where the applicant claims a composition in terms of a function, property or characteristic and the composition of the prior art is the same as that of the claim but the function is not explicitly disclosed by the

reference, the Examiner may make a rejection under both 35 U.S.C. 102 and 103, expressed as a 102/103 rejection. See MPEP 2112 III. (discussing 102/103 rejections).

I. Claim 11 is rejected under 35 U.S.C. 102(b) as anticipated by or, in the alternative, under 35 U.S.C. 103(a) as obvious over Ma, et al., *Catalytic growth of carbon nanofibers on a porous carbon nanotubes substrate*, J. Mater. Sci. Letters 2000; 19: 1329-1931 (hereinafter "Ma at __").

Claims 11 is drafted in product-by-process format. *See* Claim 11 ("obtained by the process as claimed in claim 1"). Process limitations are not given patentable weight, except to the extent they suggest structural or compositional features in the product. *See generally* MPEP 2113. Here, Claim 1 (*i.e.* the process) suggests nanotubes bound to ceramic or carbon fiber supports which can be either "nanometric" or "micrometric" sized. The addition of a catalyst suggests that a catalyst metal may also be present in the product. With respect to Claim 11, Ma teaches carbon fibers bound to carbon nanotubes. *See e.g.* (Ma at 1930) ("Fig. 5"). Catalyst is present. (Ma at 1930) ("Fig. 4").

II. Claim 12 is rejected under 35 U.S.C. 103(a) as being unpatentable over Ma, et al., *Catalytic growth of carbon nanofibers on a porous carbon nanotubes substrate*, J. Mater. Sci. Letters 2000; 19: 1329-1931 as applied to claim 11 above, and further in view of Andrews, et al., *Carbon nanotube polymer composites*, Current Opinion in Solid State and Materials Science 2004; 8: 31-37 (hereinafter "Andrews at __").

The preceding discussion of Claim 11 and Ma (rejection I. *supra*) is expressly incorporated herein by reference. With respect to Claim 12, to the extent Ma may not disclose the polymer matrix as now claimed, adding the CNT/CNF to a polymer matrix is an obvious expedient. Andrews teaches that adding carbon nanotubes and carbon nanofibers to polymer matrices is desirable to improve the mechanical as well as other properties of the composites. *See*

(Andrews, entire document). One would be motivated to do so for any number of reasons, including harnessing the thermal conductivities exhibited by CNT. *See* (Andrews at 31, col. 1) ("CNTs possess one of the highest thermal conductivities known, which suggests their use in composites for thermal management.") (citations omitted).

III. Claims 1-8 and 15-16 are rejected under 35 U.S.C. 103(a) as being unpatentable over Rao, et al., *Synthesis of multi-walled and single-walled nanotubes, aligned-nanotube bundles and nanorods by employing organometallic precursors*, Mat Res Innovat 1998; 2: 128–141 (hereinafter "Rao at __) in view of Ma, et al., Processing and properties of carbon nanotubes–nano-SiC ceramic, Journal of Materials Science 1998; 33: 5243-5246 (hereinafter "Ma II at __").

With respect to Claim 1, Rao teaches a CVD method for growing carbon nanotubes. *See generally* (Rao at 129 *et seq.*) ("Experimental"). Rao teaches argon (*i.e.* an inert), hydrogen, and benzene (*i.e.* a carbon source). *See e.g.* (Rao at 129) ("Fig."). A metallocene catalyst is recited. *Id.* The catalyst is vaporized (Rao at 132, col. 1) and passed with the carbon source into the second furnace where the nanotubes are deposited. *Id.* To the extent Rao *may* not teach the substrate/support (*i.e.* "ceramic material") required by the claims (Claims 1-4), this does not impart patentability. Ma II teaches that SiC coupled with carbon nanotubes might improve the brittleness of ceramics. (Ma II at 5243). One would be motivated to grow nanotubes on SiC for any number of reasons, for example the elimination of the mixing step Ma II employs to make their ceramics/composites. As to Claim 2, temperatures of 1173 and 1373 K (*i.e.* approx 900 and 1100 C) are taught. (Rao at 130). Recovery details are taught at (Rao at 132, col. 1) (sonication). To the extent Rao doesn't recite *in haec verba* "cooling to room temperature," it is expected that this step necessariliy occurs, as evidenced by the micrographs. Stated differently, it is highly unlikely that 1100 C nanotubes were placed in a microscope. Note also the "cold trap" shown in

the apparatus. (Rao at 129) ("Fig. 1a-c"). This is the evidence offered to show inherency. As to Claim 5 and 15, benzene is taught. (Rao at 129). As to Claims 6 and 16, ferrocene and iron pentacarbonyl are taught. *Id*. As to Claim 7, the ratios appear to be taught. (Rao at 132, col. 1). To the extent they arent, it is axiomatic that the amount of catalyst necessarily effects the rate of reaction, conversion, etc., and is readily optimized. Note also the discussion at (Rao at 133, col. 2) suggesting controlling the relative amounts. As to Claim 8, note the ratios taught at (Rao at 132, col. 1).

IV. Claims 1-4 are rejected under 35 U.S.C. 103(a) as being unpatentable over Rao, et al., *Synthesis of multi-walled and single-walled nanotubes, aligned-nanotube bundles and nanorods by employing organometallic precursors*, Mat Res Innovat 1998; 2: 128–141 as applied to claim 1 above, and further in view of US 2003/0119920 to Wang, et al.

The preceding discussion of Rao is expressly incorporated herein by reference. With respect to supports of Claims 1-4 – to the extent they are not taught by Rao, they are disclosed by Wang. *See* (Wang 3: [0042]). Growth of the nanotubes on the supports taught by Wang would allow for incorporation into the structures suggested by Wang. *See* (Wang 3: [0043] *et seq*.).

V. Claims 9-10 are rejected under 35 U.S.C. 103(a) as being unpatentable over Rao, et al., *Synthesis of multi-walled and single-walled nanotubes, aligned-nanotube bundles and nanorods by employing organometallic precursors*, Mat Res Innovat 1998; 2: 128–141 and US 2003/0119920 to Wang, et al.. as applied to claim 1 above, and further in view of US 2006/0052509 to Saitoh.

The preceding discussion of Rao and Wang is expressly incorporated herein by reference. To the extent Claims 9-10 require the coating of the support with a silane, and to the extent neither Rao or Wang discloses such a step, Saitoh discloses that silanes are useful in nanotube compositions as coupling agents. (Saitoh 15: [0092]). One would be motivated to coat the

supports of Rao and Wang with the silanes of Saitoh to aid in incorporation into other compositions, as suggested by Saitoh. (Saitoh 1: [0012] *et seq.*).

VI. Claim 12 is rejected under 35 U.S.C. 103(a) as being unpatentable over Singh, et al., *Towards the production of large-scale aligned carbon nanotubes*, Chemical Physics Letters 2003; 372: 860-865, US 5,770,099 to Rice, et al. and Peter J. Heaney, "Quartz", in AccessScience@McGraw-Hill, http://www.accessscience.com, DOI 10.1036/1097-8542.563500, accessed on 6 January, 2010 (hereinafter "Heaney at __"), as applied to claim 1 above, and further in view of Andrews, et al., *Carbon nanotube polymer composites*, Current Opinion in Solid State and Materials Science 2004; 8: 31-37.

The preceding discussion of Claim 1 accompanying the anticipation rejection *supra* is expressly incorporated by reference. With respect to Claims 12, to the extent Singh does not teach the polymer matrix, adding the CNT to a polymer matrix is an obvious expedient. Andrews teaches that adding carbon nanotubes to polymer matrices is desirable to improve the mechanical as well as other properties of the composites. *See* (Andrews, entire document). One would be motivated to do so for any number of reasons, including harnessing the thermal conductivities exhibited by CNT. *See* (Andrews at 31, col. 1) ("CNTs possess one of the highest thermal conductivities known, which suggests their use in composites for thermal management.") (citations omitted).

VII. Claims 1-4 and 13 are rejected under 35 U.S.C. 103(a) as being unpatentable over Rao, et al., *Synthesis of multi-walled and single-walled nanotubes, aligned-nanotube bundles and nanorods by employing organometallic precursors*, Mat Res Innovat 1998; 2: 128–141 in view of US 6,979,433 to Saito, et al.

With respect to Claim 1, Rao teaches a CVD method for growing carbon nanotubes. *See generally* (Rao at 129 *et seq.*) ("Experimental"). Rao teaches argon (*i.e.* an inert), hydrogen, and benzene (*i.e.* a carbon source). *See e.g.* (Rao at 129) ("Fig."). A metallocene catalyst is recited.

Id. The catalyst is vaporized (Rao at 132, col. 1) and passed with the carbon source into the second furnace where the nanotubes are deposited. To the extent Rao may not disclose the "ceramic support" required by Claims 2-4 and 13, this does not impart patentability. Metal wire deposits for growing carbon nanotubes are old and known, and the Examiner takes official notice that they are. In support of taking official notice (*i.e.* in making sure there is "substantial evidence" on the record), the Examiner provides US 6,979,433 to Saito, et al. *See e.g.* (Saito 1: 51 *et seq.*) (describing wire mesh nanotube collectors – note the claimed metals are taught). The combination appears to reflect either or both a combination of prior art elements according to known methods to yield predictable results and simple substitution of one known element for another to obtain predictable results. These bar patentability. *See* MPEP 2143. Furthermore, one of skill in the art would be motivated to employ a metal wire support to impart structural or compositional features to composites, etc.

VIII. Claims 1, 5 and 14 are rejected under 35 U.S.C. 103(a) as being unpatentable over Singh, et al., *Towards the production of large-scale aligned carbon nanotubes*, Chemical Physics Letters 2003; 372: 860-865 in view of WO 00/17102 to Smalley, et al. and Maruyama, et al., *Low-temperature synthesis of high-purity single-walled carbon nanotubes from alcohol*, Chemical Physics Letters 2002; 360: 229-234 (hereinafter "Maruyama at __").

The discussion of Claims 1 and 5 accompanying the anticipation rejection *supra* is expressly incorporated herein by reference. To the extent Singh does not employ an alcohol as the carbon source, this does not impart patentability. Use of alcohols as carbon sources in nanotube synthesis schemes is old and known, and the Examiner takes official notice that it is. In support of taking official notice (*i.e.* in making sure there is substantial evidence on the record), the Examiner provides:

1. WO 00/17102 to Smalley – *see* (Smalley 10: 15-20) ("Suitable carbon-containing compounds include . . . oxygen-containing hydrocarbons, e.g., formaldehyde, acetaldehyde, acetone, methanol, ethanol, or mixtures thereof.").

2. Maruyama – *see e.g.* (Maruyama "Abstract") ("By using alcohol as the carbon source, a new simple catalytic chemical vapor deposition technique to synthesize highpurity single-walled carbon nanotubes at low temperature is demonstrated.").

Use of this known carbon source in a known method is an obvious expedient owing to any number of advantages/motivations, etc., for example the decreased amorphous carbon, etc. *See e.g.* (Maruyama "Abstract").

Conclusion

Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to DANIEL C. MCCRACKEN whose telephone number is (571)272-6537. The examiner can normally be reached on Monday through Friday, 9 AM - 6 PM EST.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Stanley S. Silverman can be reached on (571) 272-1358. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Daniel C. McCracken/
Daniel C. McCracken
Examiner, Art Unit 1793
DCM

/Stanley S. Silverman/
SPE, Art Unit 1793